WATER RESOURCES REVIEW for

JULY
1973

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

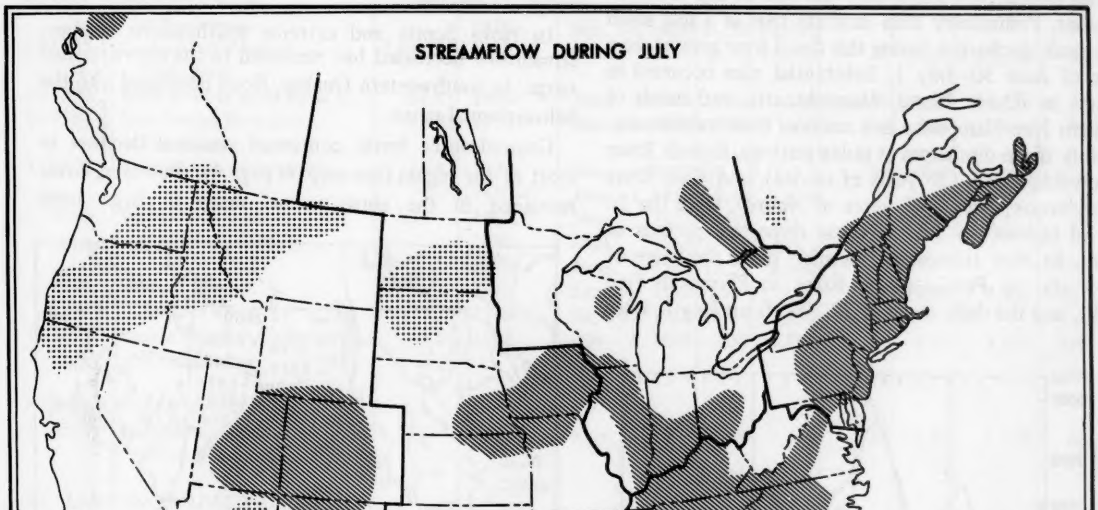
CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

STREAMFLOW AND GROUND-WATER CONDITIONS

Streamflow generally decreased in southern Canada, Hawaii, and in most parts of the conterminous United States, but increased in southern New Brunswick, nearly all of New England, and in a few basins elsewhere in the United States.

Above-normal streamflow conditions again characterized large areas in the eastern United States, and flows were in the above-normal range also in smaller areas in the southeastern, southern, and central States, and in parts of southeastern Canada. Below-normal flows persisted in many of the northwestern States, including western Montana, where agricultural drought conditions were reportedly the worst in 40 years. Below-normal flows occurred also in parts of California, Arizona, New Mexico, North Dakota, South Dakota, Alabama, and the Province of Quebec.

Moderate to severe flooding occurred in many areas, including Vermont, New Hampshire, Kentucky, North Carolina, and Virginia, in the east; and Iowa, Kansas, and Texas, in the Midcontinent region.

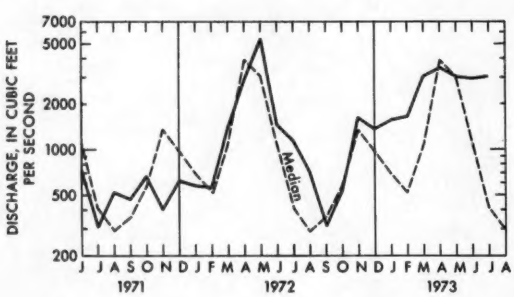


NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States]

STREAMFLOW INCREASED IN NEARLY ALL OF NEW ENGLAND AND ALSO IN PARTS OF NEW YORK, NEW JERSEY, AND NEW BRUNSWICK. SEVERE FLOODING OCCURRED IN MOST OF VERMONT AND IN NORTH-CENTRAL NEW HAMPSHIRE. FLOWS GENERALLY DECREASED, BUT WERE ABOVE THE NORMAL RANGE, IN PARTS OF THE ATLANTIC PROVINCES AND QUEBEC. FLOWS WERE BELOW NORMAL IN A SMALL AREA IN SOUTHWESTERN QUEBEC.

Torrential rains June 27–30 caused severe flooding June 30 and July 1 in most of Vermont and north-central New Hampshire. On many Vermont streams, peak discharges were the greatest since the November 1927 floods. The accompanying table and map show peak stage and discharge data and locations of selected measurement sites in those areas. Another intense rainstorm caused severe flooding July 4–5 in parts of northern and central New Hampshire and central and southern Vermont. Preliminary data indicate that in a few small areas peak discharges during this flood were greater than those of June 30–July 1. Substantial rises occurred in streams in Rhode Island, Massachusetts, and much of southern New Hampshire as a result of these two storms. Monthly mean discharges at index stations, Branch River at Forestdale, R.I. (33 years of record), and Ware River at Coldbrook, Mass. (45 years of record), were the 2d and 3d highest for July in those respective periods of record. In New Hampshire, monthly mean discharge of 3,003 cfs on Pemigewasset River at Plymouth (see graph), and the daily mean of 32,300 cfs on July 1, were



Monthly mean discharge of Pemigewasset River at Plymouth, N.H., (Drainage area, 622 square miles.)

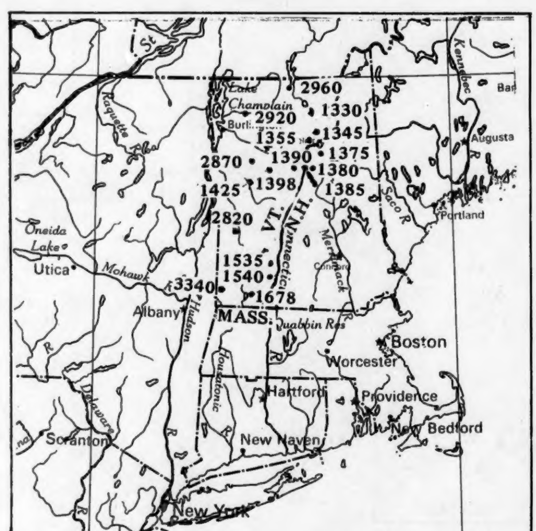
highest for the month in record that began October 1903. In Vermont, monthly mean discharge of Passumpsic River at Passumpsic (drainage area, 436 square miles), and White River at West Hartford (drainage area, 690 square miles), were highest for July in their respective periods of 45 and 58 years of record.

In central and southern Maine and parts of New Brunswick, streamflow increased and was above the normal range. The monthly mean discharge of 988 cfs, and the daily mean of 5,990 cfs on the 1st, at the index station, Piscataquis River near Dover-Foxcroft (drainage area, 297 square miles), in central Maine, were highest for the month in records that began in 1902. In southern New Brunswick and northern Nova Scotia, monthly mean discharges of Lepreau River at Lepreau and Northeast Margaree River at Margaree Valley, respectively, were highest for July in records that began in 1916.

In Connecticut, streamflow increased into the above-normal range at all index stations and generally was about 3 times the July median. Flows decreased in New Jersey but remained above the normal range for the 10th consecutive month in the southern part of the State. Monthly mean discharge of 626 cfs on Wappinger Creek near Wappinger Falls (drainage area, 181 square miles), in southeastern New York, was about 9 times the normal flow for July. In south-central New York, flow of Susquehanna River increased and was above the normal range at Conklin.

In Nova Scotia and extreme southeastern Quebec, streamflow decreased but remained in the above-normal range. In southwestern Quebec, flows decreased into the below-normal range.

Ground-water levels continued seasonal declines in most of the region (see map on page 4). However, levels remained in the above-normal range in large areas



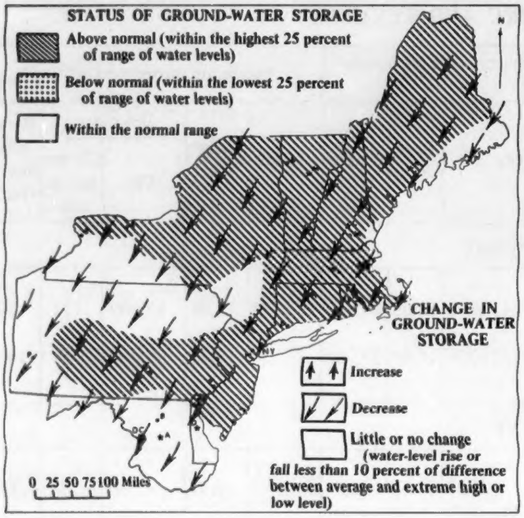
Location of stream-measurement sites in New Hampshire and Vermont, described in the table of peak stages and discharges.

Provisional data; subject to revision

STAGES AND DISCHARGES FOR THE FLOODS OF JUNE 30 AND JULY 1, 1973, AT SELECTED SITES IN NEW HAMPSHIRE AND VERMONT

WRD station number	Stream and place of determination	Drainage area (square miles)	Period of known floods	Maximum flood previously known			Maximum during present flood				
				Date	Stage (feet)	Discharge (cfs)	Date	Stage (feet)	Discharge		Recurrence interval (years)
									Cfs	Cfs per square mile	
	NEW HAMPSHIRE										
CONNECTICUT RIVER BASIN											
1–1375	Ammonoosuc River at Bethlehem Junction.	87.6	1939–	Oct. 24, 1959	12.09	10,800	June 30	11.96	10,600	121	30
1–1380	Ammonoosuc River near Bath.	395	1935–	Mar. 18, 1936	15.40	27,900	30	17.55	37,000	94	100
	VERMONT										
CONNECTICUT RIVER BASIN											
1–1330	East Branch Passumpsic River near East Haven.	53.8	1927, 1939–45, 1949–	Nov. 1927 Apr. 18, 1960	12.6 6.28	(a) 2,200	June 30	8.47	4,300	80	200
1–1345	Moose River at Victory	75.2	1947–	Apr. 25, 1970	10.61	3,010	July 1	12.04	4,340	58	200+
1–1355	Passumpsic River at Passumpsic.	436	1927, 1928–	Nov. 1927 Mar. 18, 1936	[b]31.5 21.23	(a) 16,000	1	23.49	18,200	42	200+
1–1385	Connecticut River at Wells River.	2,644	1949–	Mar. 27, 1953	15.96	54,000	1	17.35	57,100	22	40
1–1390	Wells River at Wells River ...	98.4	1940–	June 2, 1952	8.12	3,230	June 30	9.82	4,020	41	200+
1–1398	East Orange Branch at East Orange.	8.95	1958–	May 3, 1971	4.53	465	30	5.55	840	94	200+
1–1425	Ayers Brook at Randolph ...	30.5	1927, 1939–	Nov. 1927 June 1, 1952	[c]17 8.58	(a) 3,490	30	9.07	4,070	133	200+
1–1535	Williams River at Brockways Mills.	103	1927, 1938, 1940–	Nov. 1927 Sept. 1938 June 1, 1952	(d) 22.7 13.39	(a) (e) 8,910	30	13.28	8,760	85	30
1–1540	Saxtons River at Saxtons River.	72.2	1938, 1940–	Sept. 1938 Sept. 12, 1960	[f]17.9 11.57	(a) 5,610	30	13.26	7,260	101	100+
1–1678	Beaver Brook at Wilmington.	6.38	1963–	Nov. 6, 1969	7.51	1,990	30	8.61	3,100	486	(a)
HUDSON RIVER BASIN											
1–3340	Walloomsac River at North Bennington.	111	1931–	Sept. 21, 1938	12.04	8,450	30	11.28	7,540	68	25–
ST. LAWRENCE RIVER BASIN											
4–2820	Otter Creek at Center Rutland.	307	1928–	Sept. 22, 1938	13.45	13,700	30	13.25	11,500	38	200+
4–2870	Dog River at Northfield Falls.	76.1	1934–	Sept. 21, 1938	11.53	9,750	30	11.57	10,400	137	100–
4–2920	Lamoille River at Johnson.	310	1910–13, 1928–	Mar. 18, 1936	16.48	13,000	July 1	17.33	14,400	46	200+
4–2960	Black River at Coventry	122	1951–	Apr. 18, 1970	7.28	3,110	June 30	7.85	3,650	30	200+

[a]Not determined.
[b]Maximum stage since at least 1780.
[c]Maximum stage since at least 1830.
[d]Possibly 2 feet higher than that of September 1938 (backwater from mill dam).
[e]Greatest discharge since at least 1753.
[f]Maximum stage since at least 1869.



Map above shows ground-water storage near end of July and change in ground-water storage from end of June to end of July.

of 9 of the 11 States, a persisting condition from May and June. Monthend levels continued to be in the normal range in nearly all of Maryland and Delaware.

SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

STREAMFLOW INCREASED IN SMALL AREAS OF FLORIDA, KENTUCKY, NORTH CAROLINA, AND VIRGINIA, AND DECREASED IN ALL OTHER PARTS OF THE REGION. FLOWS REMAINED ABOVE THE NORMAL RANGE IN PARTS OF EACH STATE EXCEPT MISSISSIPPI AND WEST VIRGINIA. FLASH FLOODS OCCURRED IN SECTIONS OF KENTUCKY, NORTH CAROLINA, AND VIRGINIA. THE MONTHLY MEAN DISCHARGE OF THE MISSISSIPPI RIVER AT VICKSBURG RECEDED INTO THE NORMAL RANGE FOR THE FIRST TIME SINCE AUSUST 1972.

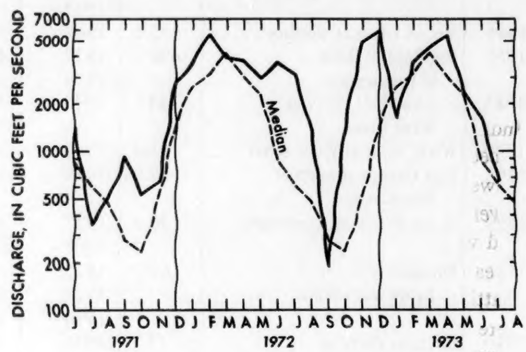
Severe thunderstorm activity caused flash flooding in several sections of Kentucky. On July 21, a total of 5.35 inches of rain fell in the greater Louisville area and was responsible for one death by drowning. Flooding also occurred in the Covington area on July 26.

In central North Carolina, frequent thunderstorms (occurring on July 1–2, 10–11, 14–17, 22–24, and 26–27) caused minor local flooding for short periods on small watersheds in urban areas. In the western part of the State, streamflow in the Tennessee River basin was above the normal range for the sixth consecutive month.

In northwest Virginia, Toms Brook Creek near Toms Brook (tributary to the North Branch Shenandoah River) had flash flooding on July 26. Preliminary report of damage caused by the flood included three deaths, more than 40 houses damaged, and some roads closed by high water.

The discharge of Silver Springs, in northern Florida, remained about the same as last month, 746 cfs; 95 percent of normal. Flow southward through the Tamiami Canal outlets, 40-mile bend to Monroe, increased 545 cfs to 560 cfs; 249 percent of normal. The flow of Miami Canal at Miami increased 174 cfs to 247 cfs; 63 percent of normal.

In southern Alabama, Conecuh River at Brantley decreased from a record-high monthly mean discharge for June into the below-normal range for July. This is the only index station in the Southeast with a flow below the normal range since February. In southeastern West Virginia, Greenbrier River at Alderson receded into the normal range, having been in the above-normal range the preceding month (see graph).



Monthly mean discharge of Greenbrier River at Alderson, W.Va. (Drainage area, 1,357 square miles.)

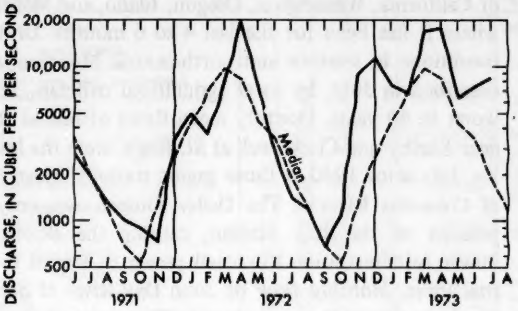
Ground-water levels generally declined. However, levels rose in central Kentucky and in most of Florida, especially in the southeastern part of the State. In heavily pumped parts of coastal Georgia, levels remained nearly the same as those of last month in the Brunswick and Savannah areas. Monthend levels were above average in most wells in Alabama, Kentucky, North Carolina (except in heavily pumped parts of the Coastal Plain), and western West Virginia; and were near or below average in the eastern part of West Virginia.

WESTERN GREAT LAKES REGION

[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

STREAMFLOW INCREASED IN SOUTHERN INDIANA, AND DECREASED IN ALL OTHER PARTS OF THE REGION. FLOWS GENERALLY WERE ABOVE THE NORMAL RANGE IN THE SOUTHERN TIER OF STATES AND IN PARTS OF EASTERN ONTARIO.

In northern Illinois, monthly mean flow of Pecatonica River remained above the normal range for the 12th consecutive month. High carryover flow from June contributed to above-normal monthly discharges in central and western Ohio, central Illinois, and northeastern Wisconsin. Monthly mean discharge of East Fork White River at Shoals, in southern Indiana, was about 4½ times the July median (see graph). Peak stages occurred July



Monthly mean discharge of East Fork White River at Shoals, Ind. (Drainage area, 4,927 square miles.)

21 on Leatherwood and Back Creeks, near Bedford, *Indiana, about 20 miles northeast of Shoals, that* exceeded those of the historic 1913 flood. In Minnesota, *flows of Minnesota River near Jordan and Mississippi* River at St. Paul, decreased into the below-normal range and were less than one half of June flows at those sites. In eastern Ontario, monthly flows of Missinaibi River at Mattice and North Magnetawan River near Burk's Falls, *were also less than those of June but were above the* normal range of flows for July.

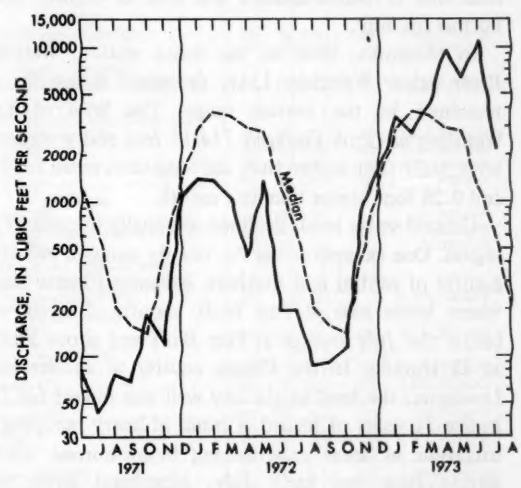
Ground-water levels declined seasonally in most wells. Monthend levels were generally above average in Indiana, Michigan, and northern Minnesota; near or above average in Ohio; and below average in southern Minnesota. In the south-central part of the State, the level in the key *well near Hanska, Brown County, was lowest for July in* the 31 years of record. In the heavily pumped *Minneapolis-St. Paul, Minn., area, levels continued to fall* and remained below average.

MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

STREAMFLOW INCREASED AND WAS ABOVE THE NORMAL RANGE IN PARTS OF KANSAS, MISSOURI, AND TEXAS. FLOWS DECREASED IN ALL OTHER PARTS OF THE REGION AND WERE BELOW THE NORMAL RANGE IN PARTS OF NORTH DAKOTA AND SOUTH DAKOTA. FLOODING OCCURRED IN KANSAS, IOWA, AND TEXAS.

In Texas, streamflow was above the normal range in the upper reaches of Rio Grande, in the west; in San Antonio and Guadalupe River basins, in the southeast; and in Neches River basin, in the east. At midmonth, *record or near-record flood peaks occurred in some* tributaries of San Antonio River. Medina River near Pipe Creek (drainage area, 474 square miles), upstream from Medina Reservoir and about 35 miles northwest of San Antonio, crested at gage height 37.3 feet, and discharge, 72,000 cfs; second highest since 1880. Cibolo Creek at Selma, about 15 miles northeast of San Antonio (drain*age area, 274 square miles), crested at gage height* 26.2 feet, and discharge, 64,000 cfs; highest since at least 1869. Flow of Guadalupe River was completely regulated at Canyon Reservoir near New Braunfels, about 35 miles northeast of San Antonio. Flood storage *impounded there at midmonth continued to be released* at monthend. The monthly mean discharge of Neches *River near Rockland decreased seasonally and remained* above the normal range for the 4th consecutive month (see graph).



Monthly mean discharge of Neches River near Rockland, Tex. (Drainage area, 3,637 square miles.)

In Kansas, streamflow increased as a result of local rains during the last half of the month, and some flooding of agricultural land occurred in the east, along Wakarusa River, south of Lawrence. Flow at the index *station on Little Blue River, in northern Kansas,* increased and was more than double the July median.

Severe flooding occurred during the first half of the month in south-central Iowa. In the eastern part of the *State, monthly mean flow of Cedar River at Cedar*

Rapids remained in the above-normal range for the 13th consecutive month; and in the southwest, flow of Nishnabotna River above Hamburg was nearly 5 times the July median.

In the adjacent area of northwestern Missouri, flow of Grand River near Gallatin increased into the above-normal range and was more than double the median for July. Cumulative runoff at that stream gaging station for the first 10 months of 1973 water year was about 4 times the 10-month median.

In the southern two-thirds of North Dakota, flow of many Missouri River tributaries was approaching zero at monthend. In South Dakota, streamflow generally was below the normal range except in the southeast, where normal flows were observed. Streamflow was near normal for the month also in Arkansas, Louisiana, Oklahoma, and Nebraska. Storage in major reservoirs in Oklahoma was at or above average at monthend. In Nebraska, irrigation storage decreased, but the demand for irrigation water from reservoirs was reduced appreciably by midmonth rains. Storage in the tributary reservoirs in North Dakota was near or slightly below normal for July.

In Manitoba, flow at the index station, Waterhen River below Waterhen Lake, decreased seasonally and remained in the normal range. The level of Lake Winnipeg at Gimli averaged 714.15 feet above mean sea level, 0.07 foot higher than the long-term mean for July and 0.28 foot higher than last month.

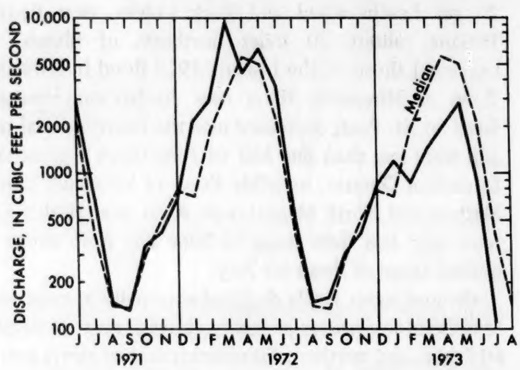
Ground-water levels declined seasonally in most of the region. One exception was the heavily pumped industrial aquifer of central and southern Arkansas (Sparta Sand), where levels rose at Pine Bluff; monthend levels were below the July average at Pine Bluff and above average at El Dorado. In the Chicot aquifer of southwestern Louisiana, the level in the key well was lowest for July in the 31 years of record, a result of heavy pumping for irrigation in areas experiencing below-normal rainfall during June and early July. Monthend levels were generally below average in North Dakota and above average in Nebraska (except in heavily pumped irrigated areas). In Texas, levels rose in the Edwards Limestone at Austin and San Antonio and in the bolson deposits at El Paso; and fell in the Evangeline aquifer at Houston; monthend levels were above average at Austin and San Antonio and below average at Houston and El Paso.

WEST

[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

STREAMFLOW GENERALLY DECREASED IN ALL PARTS OF THE REGION. FLOWS REMAINED BELOW THE NORMAL RANGE IN A LARGE AREA IN THE NORTHWEST AND ABOVE THAT RANGE IN PARTS OF ARIZONA, NEW MEXICO, COLORADO, AND WYOMING.

Streamflow remained below the normal range in parts of California, Washington, Oregon, Idaho, and Montana, where it has been for the last 4 to 6 months. Drought conditions in western and north-central Montana were described in July, by local agricultural officials, as the worst in 40 years. Monthly mean flows of Marias River near Shelby and Clark Fork at St. Regis, were the lowest for July since 1940 at those gaging stations. Mean flow of Columbia River at The Dalles, Oregon, was only 47 percent of the July median, causing the Bonneville Power Administration to curtail power to several industrial users. Monthly flow of John Day River at Service Creek, in central Oregon, was only 27 percent of the July median, and below the normal range for the 5th consecutive month (see graph). Streamflow in Idaho



Monthly mean discharge of John Day River at Service Creek, Oreg. (Drainage area, 5,090 square miles.)

generally was below median Statewide for the 4th consecutive month, and below the normal range in northern and southern parts of the State. Heavy rain showers in eastern Idaho near midmonth caused high flows on some small drainages. Flow in Kootenai River, in northern Idaho, was the 2d lowest in 61 years of record because of storage upstream in Lake Koocanusa (above Libby Dam), and below-average inflow.

Above-normal flows persisted in parts of Colorado, Wyoming, Arizona, and New Mexico, but in northern Arizona, monthly mean flow of Little Colorado River near Cameron decreased and was below the normal range for the first month since September 1972. In southwestern Arizona, flows of Salt River near Roosevelt and Gila River at head of Safford Valley, near Solomon, remained above the normal range for the 10th and 11th month, respectively.

Provisional data; subject to revision

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF JULY 1973

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	End of June 1973	End of July 1973	End of July 1972	Average for end of July	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	81	82	75	59	223,400 (a)
QUEBEC					
Gouin (P)	77	85	53	72	6,487,000 ac-ft
Allard (P)	90	84	94	74	280,600 ac-ft
MAINE					
Seven reservoir systems (MP)	97	88	97	77	179,300 mcf
NEW HAMPSHIRE					
Lake Winnipesaukee (PR)	116	99	102	86	7,200 mcf
Lake Francis (FPR)	97	94	97	88	4,326 mcf
First Connecticut Lake (P)	96	91	95	89	3,330 mcf
VERMONT					
Somerset (P)	91	82	88	82	2,500 mcf
Harriman (P)	84	70	81	78	5,060 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	91	87	86	83	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	92	82	89	82	34,270 mcf
Indian Lake (FMP)	103	96	103	89	4,500 mcf
New York City reservoir system (MW)	99	99	98	......	547,500 mg
NEW JERSEY					
Wanaque (M)	95	95	80	80	27,730 mg
PENNSYLVANIA					
Wallenpaupack (P)	85	75	79	73	6,875 mcf
Pymatuning (FMR)	98	95	101	92	8,191 mcf
MARYLAND					
Baltimore municipal system (M)	100	99	100	89	85,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	99	92	95	89	12,580 mcf
High Rock Lake (P)	89	96	79	75	10,230 mcf
Narrows (Badin Lake) (P)	96	98	92	100	5,616 mcf
SOUTH CAROLINA					
Lake Murray (P)	95	89	92	74	70,300 mcf
Lakes Marion and Moultrie (P)	92	89	90	67	81,100 mcf
SOUTH CAROLINA--GEORGIA					
Clark Hill (FP)	77	78	74	69	75,360 mcf
GEORGIA					
Burton (PR)	100	85	91	90	104,000 ac-ft
Lake Sidney Lanier (FMPR)	66	65	63	61	1,686,000 ac-ft
Sinclair (MPR)	94	86	86	91	214,000 ac-ft
ALABAMA					
Lake Martin (P)	100	96	96	90	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	75	60	64	55	1,156,000 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	86	81	82	61	1,452,000 cfsd
Douglas Lake (FPR)	85	80	76	59	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	92	89	84	75	512,200 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	92	81	90	78	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	96	87	94	84	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	91	71	68	74	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	31	32	39	39	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	98	98	98	......	22,640,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	92	91	82	74	1,948,000 ac-ft
OKLAHOMA					
Keystone (FPR)	92	94	85	95	661,000 ac-ft
Lake O' The Cherokees (FPR)	99	95	95	90	1,492,000 ac-ft
Tenkiller Ferry (FPR)	107	102	99	93	628,200 ac-ft
Lake Altus (FIMR)	75	65	28	59	134,500 ac-ft
Eufaula (FPR)	107	91	76	82	2,378,000 ac-ft
OKLAHOMA--TEXAS					
Lake Texoma (FMPRW)	105	99	83	96	2,722,000 ac-ft
TEXAS					
Possum Kingdom (IMPRW)	92	81	96	83	724,500 ac-ft
Buchanan (IMPW)	75	68	87	80	955,200 ac-ft
Bridgeport (IMW)	62	60	70	66	270,900 ac-ft
Eagle Mountain (IMW)	99	95	91	89	182,700 ac-ft
Medina Lake (I)	100	100	98	49	254,000 ac-ft
Lake Travis (FIMPRW)	97	100	90	75	1,144,000 ac-ft
Lake Kemp (IMW)	50	45	40	55	461,800 ac-ft
THE WEST					
ALBERTA					
Spray (P)	57	69	90	80	210,000 ac-ft
Lake Minnewanka (P)	91	94	93	79	199,700 ac-ft
St. Mary (I)	96	84	91	88	320,800 ac-ft
WASHINGTON					
Franklin D. Roosevelt Lake (IP)	58	76	100	94	5,232,000 ac-ft
Lake Chelan (PR)	93	99	99	99	676,100 ac-ft
IDAHO--WYOMING					
Upper Snake River (7 reservoirs) (IMP)	81	64	89	75	4,282,000 ac-ft
WYOMING					
Pathfinder, Seminoe, Alcova, Kortes, and Glendo Reservoirs (I)	94	88	74	43	3,016,000 ac-ft
Buffalo Bill (IP)	82	86	100	102	421,300 ac-ft
Boysen (FIP)	94	100	98	89	802,000 ac-ft
Keyhole (F)	86	84	91	40	199,900 ac-ft
COLORADO					
John Martin (FIR)	0	0	0	22	364,400 ac-ft
Colorado–Big Thompson project (I)	98	96	87	71	722,600 ac-ft
Taylor Park (IR)	89	101	97	92	106,000 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Navajo, and Blue Mesa Reservoirs (IFPR)	70	73	60	.....	31,276,500 ac-ft
UTAH--IDAHO					
Bear Lake (IPR)	88	85	96	64	1,421,000 ac-ft
CALIFORNIA					
Hetch Hetchy (MP)	100	97	81	77	360,400 ac-ft
Lake Almanor (P)	92	93	81	57	1,036,000 ac-ft
Shasta Lake (FIPR)	96	89	82	81	4,377,000 ac-ft
Millerton Lake (FI)	100	78	36	65	503,200 ac-ft
Pine Flat (FI)	94	74	25	52	1,014,000 ac-ft
Isabella (FIR)	72	62	24	36	551,800 ac-ft
Folsom (FIP)	94	82	84	80	1,000,000 ac-ft
Lake Berryessa (FIMW)	95	92	76	82	1,600,000 ac-ft
Clair Engle Lake (Lewiston) (P)	97	91	91	87	2,438,000 ac-ft
CALIFORNIA--NEVADA					
Lake Tahoe (IPR)	92	86	82	71	744,600 ac-ft
NEVADA					
Rye Patch (I)	106	101	93	.....	157,200 ac-ft
ARIZONA--NEVADA					
Lake Mead and Lake Mohave (FIMP)	81	80	66	72	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	74	70	2	12	1,093,000 ac-ft
Salt and Verde River system (IMPR)	96	89	33	38	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	87	85	46	78	352,600 ac-ft
Elephant Butte and Caballo (FIPR)	31	33	5	26	2,539,000 ac-ft

[a] Thousands of kilowatt-hours.

METRIC EQUIVALENTS OF UNITS USED IN THE WATER RESOURCES REVIEW

(Round-number conversions, to nearest four significant figures)

1 foot = 0.3048 meter
1 acre = 0.4047 hectare = 4,047 square meters
1 square mile = 259 hectares = 2.59 square kilometers
1 acre-foot (ac-ft) = 1,233 cubic meters
1 million cubic feet (mcf) = 28,320 cubic meters
1 cubic foot per second (cfs) = 0.02832 cubic meter per second
1 second-foot-day (cfsd) = 2,447 cubic meters per day
1 million gallons (mg) = 3,785 cubic meters = 3.785×10^6 liters
1 million gallons per day (mgd) = 2.629 cubic meters per minute = 3,785 cubic meters per day
1 million cubic feet = 28,317 cubic meters

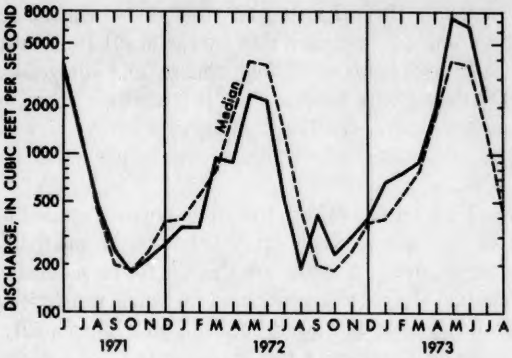
Provisional data; subject to revision

FLOW OF LARGE RIVERS DURING JULY 1973

Station number	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1970 (cfs)	July 1973					
				Monthly discharge (cfs)	Percent of median monthly discharge[1]	Change in discharge from previous month (percent)	Discharge near end of month		
							(cfs)	(mgd)	Date
1-0140	St. John River below Fish River at Fort Kent, Maine.	5,690	9,397	4,786	103	-59	2,100	1,400	31
1-3580	Hudson River at Green Island, N.Y.	8,090	12,520	10,093	186	-22	....	....	.....
1-4635	Delaware River at Trenton, N.J	6,780	11,360	18,088	357	+37	5,860	3,800	28
1-5705	Susquehanna River at Harrisburg, Pa.	24,100	33,670	19,050	164	-41	14,900	9,600	31
1-6465	Potomac River near Washington, D.C.	11,560	[2]10,640	5,900	134	-54	4,200	2,700	31
2-1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	4,847	6,286	287	-13	2,740	1,800	30
2-1310	Pee Dee River at Peedee, S.C	8,830	9,098	10,800	184	-24	12,900	8,300	27
2-2260	Altamaha River at Doctortown, Ga.	13,600	13,380	10,720	150	-53	8,900	5,800	26
2-3205	Suwannee River at Branford, Fla	7,740	6,775	12,600	251	-34	8,850	5,700	28
2-3580	Apalachicola River at Chattahoochee, Fla.	17,200	21,690	17,300	111	-53	16,400	10,600	30
2-4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	21,700	17,930	303	-34	13,200	8,500	25
2-4895	Pearl River near Bogalusa, La	6,630	8,533	3,487	122	-48	3,460	2,200	25
3-0495	Allegheny River at Natrona, Pa	11,410	[2]18,700	4,930	82	-69	5,160	3,300	30
3-0850	Monongahela River at Braddock, Pa.	7,337	[2]11,950	2,910	71	-62	2,190	1,400	30
3-1930	Kanawha River at Kanawha Falls, W.Va.	8,367	12,370	6,543	135	-54	7,430	4,800	25
3-2345	Scioto River at Higby, Ohio	5,131	4,337	6,750	427	-30	12,700	8,200	27
3-2945	Ohio River at Louisville, Ky[3]	91,170	110,600	73,300	169	-46	83,500	54,000	29
3-3775	Wabash River at Mount Carmel, Ill.	28,600	26,310	32,670	223	-24	55,100	35,600	31
3-4690	French Broad River below Douglas Dam, Tenn.	4,543	[2]6,528	5,477	134	-48	....	....	.....
4-0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[3]	6,150	4,142	3,100	107	-66	....	....	.....
4-2643.31	St. Lawrence River at Cornwall, Ontario-near Massena, N.Y.[4]	299,000	239,100	350,000	136	0	350,000	226,000	31
5-0825	Red River of the North at Grand Forks N. Dak.	30,100	2,439	495	17	-52	370	200	31
5-3300	Minnesota River near Jordan, Minn	16,200	3,306	1,691	44	-72	1,310	800	30
5-3310	Mississippi River at St. Paul, Minn	36,800	[2]10,230	5,815	49	-63	4,940	3,200	30
5-3655	Chippewa River at Chippewa Falls, Wis.	5,600	5,062	2,757	74	-61	....	....	.....
5-4070	Wisconsin River at Muscoda, Wis	10,300	8,457	6,002	90	-63	....	....	.....
5-4465	Rock River near Joslin, Ill	9,520	5,288	8,000	230	-51	5,560	3,600	31
5-4745	Mississippi River at Keokuk, Iowa	119,000	61,210	64,400	97	-56	54,400	35,000	31
5-4905	Des Moines River at Keosauqua, Iowa.	14,038	5,220	20,900	359	+3	20,600	13,000	31
6-2145	Yellowstone River at Billings, Mont.	11,795	6,754	10,810	72	-48	6,000	3,900	31
6-9345	Missouri River at Hermann, Mo	528,200	78,480	88,660	112	-21	169,000	109,000	25
7-2890	Mississippi River near Vicksburg, Miss.[5]	1,144,500	552,700	612,300	134	-51	536,000	346,000	30
9-3150	Green River at Green River, Utah	40,600	6,369	8,888	138	-53	....	....	.....
9-4025	Colorado River near Grand Canyon, Ariz.	137,800	....	10,320	....	-17	....	....	.....
11-4255	Sacramento River at Verona, Calif	21,257	18,370	12,710	160	+7	14,400	9,300	25
13-2690	Snake River at Weiser, Idaho	69,200	17,670	9,766	90	-12	11,000	7,100	.....
13-3170	Salmon River at White Bird, Idaho	13,550	11,060	6,920	53	-63	5,650	3,700	.....
13-3425	Clearwater River at Spalding, Idaho	9,570	15,320	7,123	75	-53	4,940	3,200	.....
14-1057	Columbia River at The Dalles, Oreg.[6]	237,000	194,000	130,700	47	-9	....	....	.....
14-1910	Willamette River at Salem, Oreg	7,280	23,370	6,069	85	-2	6,000	3,900	.....
15-5155	Tanana River at Nenana, Alaska	27,500	24,040	53,860	92	+11	45,000	29,000	31
8MF005	Fraser River at Hope, British Columbia.	78,300	95,300	179,000	98	-19	169,000	109,000	20

[1] Reference period 1931-60 or 1941-70.
[2] Adjusted.
[3] Record furnished by Corps of Engineers.
[4] Record furnished by Buffalo district, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[5] Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[6] Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

In California, streamflow remained below the normal range in the north-coastal area but was in the normal range elsewhere. Monthly mean discharge of Kings River above North Fork, in the east-central part of the State, decreased seasonally and was in the normal range (see graph).



Monthly mean discharge of Kings River above North Fork, Calif. (Drainage area, 952 square miles.)

Mean flow at all index stations in Colorado was in the above-normal range for July and west-slope runoff was especially high. The monthly mean discharge of 2,366 cfs on Animas River at Durango (drainage area, 692 square miles) was almost 3 times the median flow for July. In Utah, the level of Great Salt Lake declined 0.40 foot during the month (to 4,199.85 feet above mean sea level), and was 1.15 feet higher than a year ago.

Reservoir storage at monthend generally was near or above average except in southern Idaho and Washington. Monthend contents of Bear Lake, in. Utah, was 1,212,500 acre-feet compared to 1,367,600 acre-feet on July 31 last year. Contents of the Colorado River Storage Project increased 978,900 acre-feet during July.

Ground-water levels generally rose in Utah and in the Boise Valley of southern Idaho; changed only slightly in Montana; and declined in Washington and much of Nevada and southern Arizona. Monthend levels were above average in east-central Nevada and in the Atomic City and Eden areas of southern Idaho (Snake Plain aquifer); near or below average in Utah and southern California; and below average in Montana, Washington, and southern and north-central Nevada.

ALASKA

Streamflow was near normal in most of the State. However, flow of Kenai River at Cooper Landing remained in the below-normal range because of lack of rainfall and was the second lowest for the month in 26 years of record.

Ground-water levels declined in the Anchorage and Kenai areas.

WATER RESOURCES REVIEW **JULY 1973**

Cover map shows generalized pattern of streamflow for July based on 22 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for July 1973 is compared with flow for July in the 30-year reference period 1931–60 or 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for July is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being within the *normal range*. In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the July flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of July. Water level in each key observation well is compared with average level for the end of July determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels,* unless described otherwise, are from the end of June to the end of July.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Washington, D.C. 20244.

This issue was prepared by J.C. Kammerer, H.D. Brice, E.W. Coffay, and L.C. Fleshmon from reports of the field offices, August 8, 1973.

WATER FACTS AND FIGURES FOR PLANNERS AND MANAGERS

The accompanying abstract, text (abridged excerpt), and illustration are from the report, *Water facts and figures for planners and managers*, by J. H. Feth: U.S. Geological Survey Circular 601-I, 30 pages, 1973. Circular 601-I may be obtained free on application to the U.S. Geological Survey, Washington, D.C. 20244.

ABSTRACT

Water is defined in terms of its chemical composition and dominant physical properties, such as expansion on freezing and high surface tension. Water on the earth is about 97 percent in the seas, 2 percent in glacier ice, principally Greenland and Antarctica. Man is left with less than 1 percent as liquid fresh water to sustain his needs. This is possible under good management because water moves cyclically. Conjunctive use of surface and ground water is advocated, as is reuse of wastewater. Water needs for domestic and light industrial use can be reasonably forecast for planning purposes. Heavy-industry needs must be determined on a site-by-site basis.

The units commonly used by hydrologists with respect to quantities and quality of water are defined; their significance in water management is outlined, and metric-English equivalents are given for many. A glossary of terms concludes the report which is intended as a reference work for use by planners and managers.

Abridged excerpt from report:

pH

The *pH* of a solution (such as water) is defined as the negative logarithm, to the base 10, of the hydrogen-ion activity. The pH scale runs from 0–14. On the scale, 7.0 is neutral . . . . . . each unit change in pH [such as from 7.0 to 8.0] represents a 10-fold change in hydrogen-ion concentration. Partly because the pH is sensitive to many environmental influences, this property of water is a very useful index to the balance of chemical forces in the water in its natural state.

Figure 1 shows that [most] unpolluted natural waters tend to have a narrow pH range not far from neutrality. Narrow ranges, near neutrality, are the rule for most beneficial uses of water. The range in water used for public supply is surprisingly wide, a testament again to man's great adaptability—he can tolerate a wider pH range than most fish, for instance. The vast pH range of untreated wastewaters illustrates their potential impact on receiving waters. Discharge of untreated waste may change the pH of lakes, streams, and estuaries to ranges outside the tolerance of some or all organisms present.

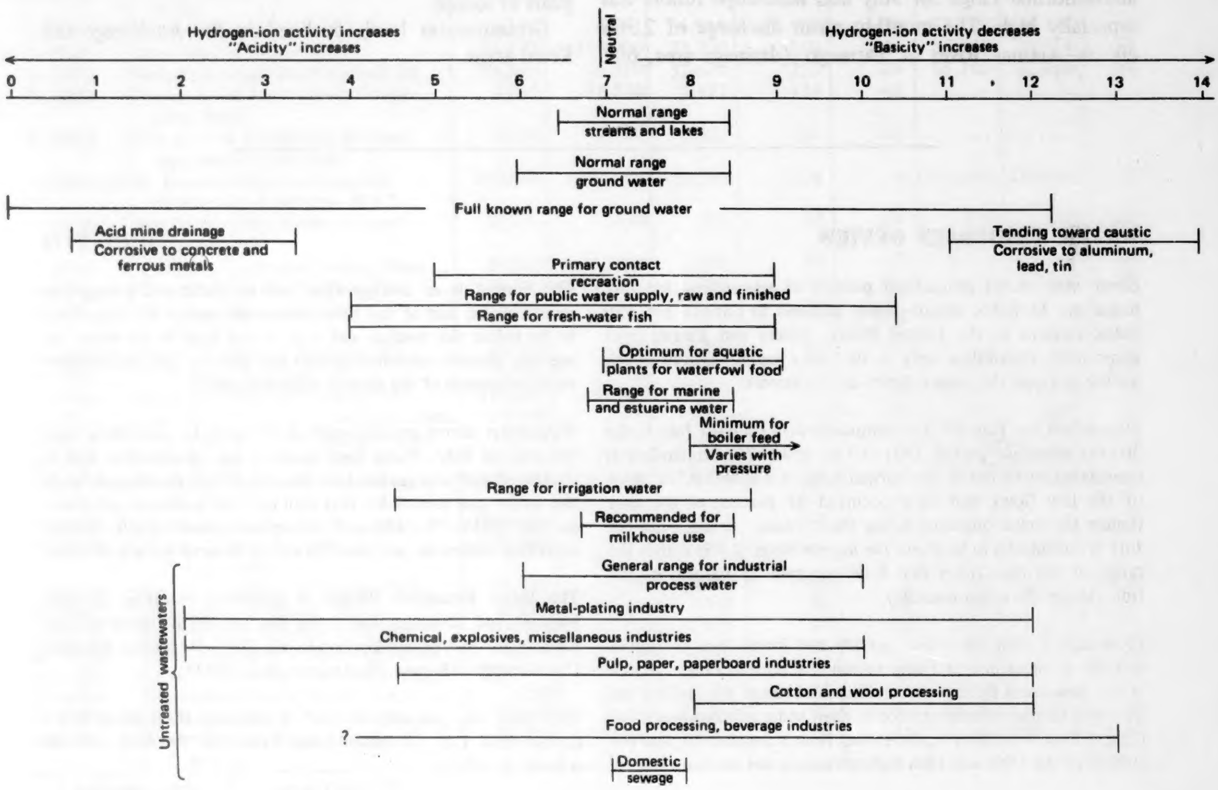


Figure 1.—pH ranges in relation to use. [References: White, Hem, and Waring (1963), FWPCA (1968), Hem (1970), Rudolfs (1953), Ciaccio (1971), and Comp (1963).]